State of Utah

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

Department of Administrative Services
D'ARCY DIXON PIGNANELLI
Executive Director

Division of Facilities Construction and Management
F. KEITH STEPAN
Director

ADDENDUM #1

Date:	13 March 2006
To:	Contractors
From:	Darrell Hunting, DFCM – Project Manager
Reference:	Bridgerland Applied Technology Campus – Boiler Replacement and Control Upgrade DFCM Project No. 06011210
Subject:	**Addendum No. 1**

Pages	Cover Page	1 page
	Sheet MH501	2 page
	Section 15900 HVAC Instrumentation and controls	13 pages
	Total	**16 pages**

Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

1.1 Schedule Changes: There are no schedule changes per this Addendum.

End of Addendum

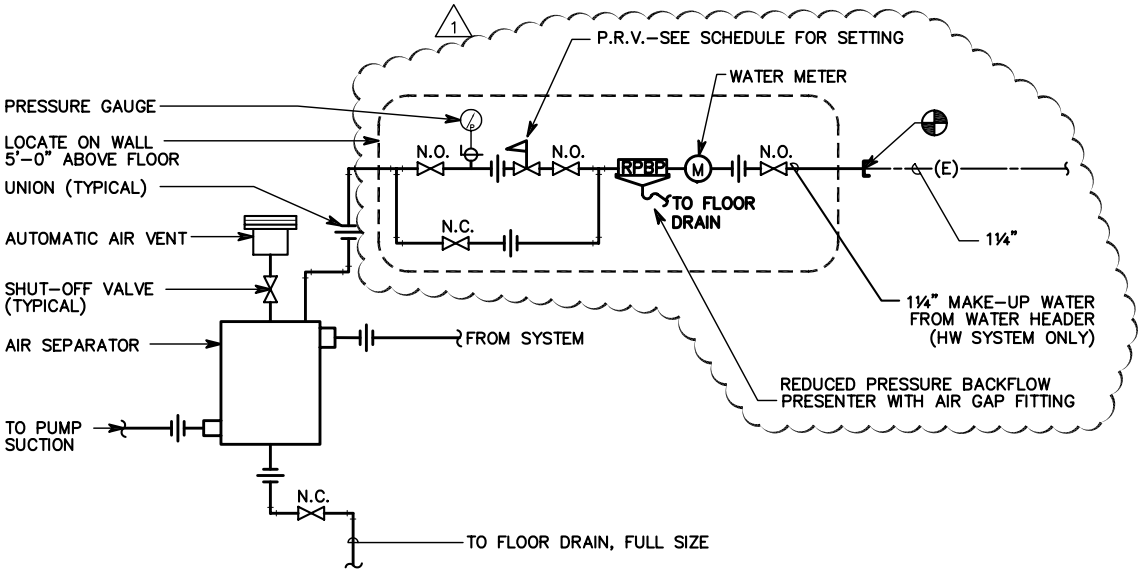
Addendum

Job: BATC Boiler Replacement
Job Number: 01290210
Date: March 10, 2006

MECHANICAL – DIV 15

DRAWINGS

SHEET - MH501
1. Detail A4/MH501. Move reduced pressure backflow preventor location upstream of PRV bypass. See attached.



A4 AIR SEPARATOR DETAIL

SCALE: NOT TO SCALE

SPECTRUM ENGINEERS
175 South Main Street, Suite 300
Salt Lake City, Utah 84111
801-328-5151 800-678-7077
FAX 801-328-5155
www.spectrum-engineers.com

REFERENCE:	MH501
ISSUE:	ADDENDUM 1
DATE:	03/10/06
PROJ NO:	20050235
DRAWN BY:	SCM
CHECKED BY:	RDV

PROJECT **BATC BOILER REPLACEMENT**

SHEET TITLE **DETAILS**

SCALE NTS

MH-501-R1-1

SECTION 15900 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. All pertinent sections of this specification may be part of the work described in this section. This contractor will require coordination of other trades. This contractor will have a project manager, with not less than five years experience, on site when ATC work commences to coordinate daily work activities.

1.2 SCOPE OF WORK:

A. The scope of work shall include all labor, material, and equipment necessary to extend the existing Tour Andover Controls (TAC) INET temperature control system from the maintenance command center to the new boiler system per the following sequence of control. The scope of work shall also include the complete removal of the remaining Johnson Controls Metasys system and the replacement of the system utilizing the TAC INET DDC system. All material removed shall be returned to the owner. The sequence of operation in this specification shall give general guidelines for the equipment to be controlled. It shall be the ATC contractor responsibility to extend the TAC INET control system to all equipment now being controlled by the existing system that may have been omitted in the sequence of operation.

B. The ATC contractor shall furnish and install new variable frequency drives (VFDs) for each of the AHU systems. The existing AHU VFDs shall be removed and returned to the owner. Each VFD shall be a single packaged system with all control interfaces, bypass arrangement, filtering and protective devices contained in a single integrated system enclosure.

C. The temperature controls shall be installed and certified by the ATC contractor utilizing TAC Controls (INET-Seven) as specified. The installation of the DDC system must be approved and certified by the controls manufacturer.

D. Install a new Direct Digital Control (DDC) system to be tied into the existing Host Computer. This DDC System shall operate over the owners WAN Network and shall include a Web Server to allow the control system to be viewed and controlled by a standard Web browser.

E. This system shall include, but not are limited to, controls and equipment as hereinafter specified:

F. This system shall include but not be limited to controls and equipment as hereinafter specified.
1. VAV Boxes
2. Air Handling Units (including new VFD systems)
3. Boiler and Pumps
4. Exhaust Fans
5. Hot Water Recirculating Pumps
6. Relief Air Systems
7. Make-up Air Units

G. The Temperature Control Contractor under this section shall provide all control equipment hereinafter specified.

H. All Control equipment shall be manufactured by the temperature control companies listed in the bidding section of these documents.

1.3 WORK TO BE PERFORMED BY OTHERS

A. The Contractor shall carefully review all notes, coordination schedules, and drawings for work required under this section of the specification.

B. Division 16 shall furnish and install all single phase and multiple phase electrical power wiring to magnetic starters, disconnect switches, and motors. Division 16 shall also provide 120 power to each ATC panel as shown on the plans. ATC contractor shall be responsible for step down transformers and 24 VAC wiring to ATC equipment. The ATC contractor shall be responsible for the installation of the AHU VFD systems.

C. The sheet metal contractor shall install all dampers supplied by the ATC contractor. Each damper shall be installed so that it will operate freely and without binding. Each damper shall be checked and those not properly installed shall be replaced or reinstalled without cost to the ATC contractor.

1.4 RELATED WORK:

A. Mechanical Contractor to install all control valves, wells for temperature sensors, and this contractor to supply location and temperature sensors wells.

1.5 ELECTRICAL WIRING:

A. The controls contractor shall hold a current electrical license for the State of Utah (no subcontracting shall be allowed on this project) and shall install all wiring and conduit for the DDC and AHU VFD systems. All power wiring to control panels will be done by the division 16 contractor.

B. All control wiring shall be installed in conduit in open areas and concealed inaccessible ceilings in accordance with the National Electrical Code. Plenum rated cable may be used in concealed accessible areas in accordance with the National Electrical Code. The existing wiring may be used as long as it meets National Electrical Code and is of professional workmanship.

1.6 SUBMITTALS:

A. Prior to any installation, the Contractor shall submit, with 20 days after award of contract, a complete submittal package. This submittal shall contain six (6) copies of complete literature on all control equipment including control diagrams as per the sequence of operation.

B. The Following shall be submitted for Approval
1. Data sheets for all control systems and components.
2. Valve schedules, showing sizes, configuration capacity and location of all equipment.
3. Control system drawings containing pertinent data to provide a functional operating system, including a sequence of operation. Detailed shop drawings may be submitted in an as installed form upon project completion.

C. Drawings:
1. After completion of contract, the Supplier shall submit review drawings, installation and operation instruction and a recommended spare parts list.
2. Drawings shall be standard sizes (24 inches x 36 inches) or (11 inches x 17 inches).
3. Provide three copies of as installed drawings.

D. System documentation by the Vendor shall include the following as a minimum:
1. System configuration diagrams in simplified block format.
2. Input/Output point and alarm point summary listing.
3. Electrical drawings showing all system internal and external connection points, terminal block layouts and terminal identification.

4. Manufacturer's instructions and drawings for installation, maintenance and operation of all purchased items.
5. Overall system operation and maintenance instructions, including preventive maintenance and troubleshooting instructions.
6. Complete recommended spare parts list.

1.7 PROJECT MANAGEMENT:

A. Provide a designated project manager who will be responsible for the following:
1. Maintain project schedule
2. On-site coordination with all applicable trades and subcontractors
3. Attend project meetings
4. Make necessary field decisions

1.8 WARRANTY:

A. Provide all services, materials and equipment necessary for a **one-year** period after substantial completion inspection.

1.9 TRAINING:

A. Training will consist of a total of 8 hours. Classes will be broken into separate sessions at the owner’s discretion.

1.10 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 13 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Division 16 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

PART 2 - PRODUCTS AND EQUIPMENT:

2.1 APPROVED MANUFACTURERS AND INSTALLERS

A. Approved DDC control equipment:
1.TAC INET (no exceptions)
a.Approved Installation Contractors:
1)Utah Controls Inc. David Rossiter 801-990-1950

2.2 VALVES:

A. ATC valve bodies 2” and smaller shall be screw type; larger valves shall be flanged. Screwed valves shall be rated at 150 psi or greater and shall have cast iron or brass bodies. Flanged valves shall be rated at 250 psi or greater and have cast iron or steel bodies. All automatic valves shall be for DDC control application. All valves shall be disc/plug and seat or ball construction. Valves to be sized for a 3-lb. max. pressure drop.

2.3 DAMPERS:

A. The ATC contractor shall furnish motorized control dampers that are not supplied with the air handling units. All dampers shall be factory-built, low leakage units such as Ruskin CD-50 or equal. Blades shall be 6" maximum width; material to be extruded aluminum, and blade linkage to be external and accessible. Frames shall be 5" x 1" and made of extruded aluminum hat channel, 0.125" minimum thickness with corner braces to assure that they are square. Dampers shall be low leakage type with compressible end seals and neoprene of extruded vinyl blade and jamb seals. Leakage shall be not exceed 6.2 cfm/sq. ft. at 4" W.G. Dampers shall require less than 7#-in/sq. ft. torque at the operating shaft.

2.4 BUILDING MANAGEMENT SYSTEM (BMS):

A. The building management system shall permit full operator communication and control, including obtaining information about performance of this system; changing times and parameters; adding or deleting points; changing relationships between sensors and controlled equipment; creating or modifying control strategies; and diagnosing system malfunctions. English language prompting format shall be used. The operator will be presented with options at the CRT in English. Features of the system will be compatibility to run on Windows 2000 or NT. System to have integrated access control; TCP/IP protocol communication; support for net plus routers; open database support; integrated graphic editor; asynchronous auto-dial/auto answer, and one way dialing. This Contractor shall provide all software required for efficient operation of all the automatic system functions required by this specification. Software shall be modular in design for flexibility in expansion or revision of the system. It is the intent of this specification to require provisions of a system, which can be fully utilized by individuals with no, or limited, previous exposure to PC's and programming techniques and languages. If the system to be provided requires the use of any modified BASIC, "C", PASCAL, or DRUM Language program, or writing "line" programming statements to modify operation or strategy in the system, the vendor shall provide unlimited, no charge, software modification and support for a period of five (5) years after the completion of the project in addition to the warranty period specified elsewhere. Systems, which are factory programmed, are unacceptable. Direct Digital Control (DDC) Modules: Each DCU shall provide "Block" or "Modular" programming software so that the operator can easily develop custom control strategies and sequences of operation, without learning a programming language.

B. Control loops and sequences shall be defined using "modules" that are analogous to traditional pneumatic or electric control devices. Modules may be linked together to form more complex control strategies. The use of mathematical equations, "BASIC", or proprietary programming languages for defining a DDC control loop is unacceptable.

2.5 LOCAL AREA NETWORKS (LAN):

A. Controller LAN: The FMS shall provide communication between the DCU's over a Local Area Network (LAN).

B. The Controller LAN shall be a "bus type" network over which information is transmitted in a "token passing" fashion between all the nodes on the network.

C. The Controller LAN shall have the capacity to contain not less than 64 nodes as a minimum. Each workstation, DCU, or "gateway" device shall represent a node to the nework.

D. The Controller LAN shall connect the nodes in a fully distributed environment, each DCU operating autonomously while communicating with all other nodes on the network. Controller LANs requiring a communication controller (for any reason) will not be acceptable. LAN lengths in excess of 24,000 ft. shall be supported.

E. A break in the communication path of the Controller LAN shall be announced as an alarm and shall automatically initiate a Controller LAN reconfiguration such that the resulting sections of the

Controller LAN continue to function as separate LANs. No loss of control shall result from such a break in the Controller LAN.

F. Commercial LAN: Workstations on the Controller LAN may also reside on a higher tier "commercial" LAN. This "commercial" LAN shall be based on Ethernet, and comply with IEEE 802.3 standards. Where a "commercial" LAN is implemented, it shall be possible to connect multiple Controller LANs together, with global data sharing across this commercial LAN.

G. Data speed shall not be less than 10 Megabaud.

H. An operator at a workstation on the "commercial" LAN may connect to any other workstation on the "commercial" LAN as if the operator were sitting at the other workstation.

I. Alarms and special event notices shall be routed to different workstations on the "commercial" LAN based on time of day, and day of the week.

2.6 REFERENCE STANDARDS

A. The latest edition of the following standards and codes in effect and amended as of date of Supplier's Proposal, and any subsections thereof as applicable, shall govern design and selection of equipment and material supplied:

1. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
2. IBC International Building Code, including local amendments
3. UL 916 Underwriters Laboratories Standard for Energy Management Equipment
4. NEC National Electrical Code

B. City, county, state, and federal regulations and codes in effect as of date of purchase.

C. Except as otherwise indicated, vendor shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

PART 3 - EXECUTION

3.1 DIRECT DIGITAL CONTROL SYSTEM-OVERVIEW:

A. The direct digital control system shall consist of local microprocessor-based digital control panels (DCP) network together for information sharing and operating convenience and a central operator interface station.

B. It is the intent of these specifications to create a combined direct digital control system. All system type control functions, such as those used for fan systems, boilers, chillers, central plant and pumps, building pressure, etc., shall be accomplished by using software algorithms in the respective DCP.

C. Each major mechanical component (fan system, chiller, boiler, etc.) shall have its own dedicated DCP so that failure of any will not result in catastrophic system failure. DCP’s utilizing a master-slave relationship shall have a master unit provided for each major mechanical system.

D. All safety devices such as fire alarm shutdown, smoke detectors, low limit thermostats, etc., shall be hard wired to accomplish their critical functions completely independent of the DCP and shall have additional outputs as required to sever as inputs to the DCP for secondary control and reporting functions.

3.2 CONTROLLER (DCU):

A. The controller shall be a microprocessor and shall form the basic control unit of the system. It shall operate as a stand-alone unit providing all the necessary algorithms and software logic to perform the local HVAC control sequences and energy saving functions. Failure of any one DCU shall have no effect on the other DCU's in the system. Programming shall be block type and accomplished by the operator's terminal, or the remote operator terminal. The DCU shall have the ability for direct digital control; automatic time scheduling; demand limiting; calculated points universal inputs with configurable outputs; an RS-485 Lan port; an RS-232 port; an TTL port for hand held console; trend sampling, and on line editing capability. The controller shall operate independent of any central computer, shall have built in diagnostic routines, and shall have 72-hour battery back up.

B. Inter-computer communications shall support true global token passing control strategies as well as allow data status and values connected to one DCU to be used within application programs of another DCU.

C. The system shall provide a network communication facility to support global calculation and control strategies to be continuously implemented in the distributed system. The system shall provide for events detected in any area of the total network to initiate commands to any other device within the network. The system shall also provide for connected or calculated data to be continuously shared between any or all controllers within the total network. Through the DCU's may share none critical sensor information, at no point within the facility shall quick reacting and constantly changing point information be communicated via the network bus. These types of point shall be hardwired to the DCU in which the algorithm exists.

3.3 SOFTWARE:

A. This contractor shall provide the most current version of all programming, monitoring, graphic development and DDC operator software. The existing building automation software (including access control) shall be upgraded to the most recent software version available. TAC I/NET Version Seven will be installed by the ATC contractor on the Host Computer located in the maintenance office. Microsoft Windows XP Professional operating system will be installed on the existing host computer supplied by the owner, if the existing host computer needs to be upgraded to be compatible with the new operating system software, the owner will provide the new host system to meet the requirements.

B. Copies of all software releases available within one year of the substantial completion shall be provided to the owner at no cost.

3.4 ROUTER and SECURITY OF CONTROL SYSTEM:

A. Provide and install an Ethernet router at this site to provide constant on-line monitoring by the facility personnel. This device shall serve as the network interface between the ATC control/controllers at the remote site and the existing Wide Area Network (WAN). This router to tie directly to the TAC control system. The router shall support the following protocol, Telnet via TCP, SNMP via UDP, and ATC contractor's proprietary protocol via UDP. The router shall require a Static IP address, Subnet Mask and Gateway provided by the network administrator. The maximum allowable transmission/response packet sizes shall not exceed 186 bytes, and acknowledge/response packet sizes shall not exceed 64 bytes. UDP packets shall be proprietary to the control system with critical packets using a private key encryption for security.

3.5 AIR DUCT SMOKE DETECTORS:

A. Smoke detectors shall be furnished and wired by Division 16. The electrical contractor shall interlock all smoke detectors with the building fire alarm system.

3.6 TEMPERATURE SENSORS:

A. Provide thermistor or thin film silicon sensors for all temperature applications, except differential chilled water for BTU calculation, where precision matched Platinum RTDs shall be used. Solid-state sensors shall be linear, drift free, and require only a one-time calibration. A look-up table in the connected controller shall linearize thermistors or similar non-linear temperature devices. Resolution shall be better than .5 degrees F for Micro Controller applications, and better than .2 degrees F for DCP applications.

B. Space sensors shall have an integral port for connection of a portable “intelligent” sensor to communicate with its DCP. This port and portable “intelligent” sensor may be used for initiating the "test mode" locally to verify all DCP control sequences, and perform test and balancing functions. To eliminate the downtime associated with rechargeable batteries, the portable “intelligent” sensor shall receive its power from the sensor port.

3.7 VARIABLE FREQUNCEY DRIVES:

A. The following VFD manufacturer’s equipment have been pre-approved to meet the products section of this specification:
1. Motor Drives International
2. Square D International
3. Mitsubishi

B. Submittals
1. Submit manufacturer’s product data on the VFDs
2. Submit shop drawings including dimension drawings, power drawing, control drawing and operator device layout drawings.
3. Submit harmonic distortion calculations or data for limit guarantees meeting specification requirements.

C. The VFD shall be supplied as a complete, pre-integrated, stand-alone package produced by a single manufacturer regularly engaged in the production and who maintains full system support responsibility.
1. The VFD system manufacturer shall integrate all components and equipment required to meet these specification features and functions as a single UL labeled system. Vendors providing equipment requiring field integration of separate components shall not be acceptable.
2. Pre-integrated equipment shall include but not be limited to incoming protective equipment, line filters, inverter unit, control circuitry, operator interfaces, bypass arrangement and accessories and auxiliary items required to meet the highest standards for the type of service specified herein.

D. Application
1. Provide VFD units, which are applicable to variable torque fan loads. The entire system unit shall be capable of 110% overload for one minute in the rated environment.
2. Provide equipment that is rated for continuous operation at 4500 feet above sea level in an operating temperature range of 0-40 degrees C.
3. Provide units constructed in an enclosure system rated for indoor environments.

E. Protection
1. Provide short circuit protection by means of an externally operated, door interlocked circuit breaker or motor circuit protector (MCP). Provide provisions for the handle to be locked off to meet NEC requirements.
2. Provide VFD operated motor overload protection by means of programmable, speed sensitive, electronic overload circuits with instantaneous trip, inverse time trip and current limit func-

tions. In the bypass mode, provide motor overload relay set to protect the motor and capable of starting across line.

F. Construction
1. Provide NEMA configuration enclosure for each VFD system. The enclosure shall be either wall mounted or free standing, as required with force ventilation. Mount all components in a single enclosure including, but not limited to, the VFD unit, contactors, door interlocked circuit breaker, bypass/isolating equipment, harmonic filter units, line reactors, and/or other items listed ion the specifications or on the drawings.
2. Indoor enclosures shall be NEMA 1 force filter ventilated with an intake air filter to create a positive internal pressure. The air filter must be accessible from the enclosure front and easily changed without shutting down the system.
3. Provide a “machine tool” type control transformer with primary and secondary fusing. All control power shall be 120 volt.
4. Operator Devices: Provide door mounted, industrial type, oil tight operator devices for the following required functions.
   a. Hand/Off/Auto switch
   b. VFD/Bypass switch
   c. Power on light
   d. VFD run light
   e. Bypass run light
   f. VFD fault light
   g. External fault light
5. Customer Terminations: Provide customer termination points for the following:
   a. Safeties interlock
   b. Remote start/stop
   c. Remote VFD fault annunciation
   d. Remote motor run annunciation
   e. Remote speed signal input (0-10vdc or 4-20mA)
6. Bypass: Provide VFD system with a manual bypass contactor arrangement for transfer to the feeder line to operate at constant speed. The contactors shall be electrically and mechanically interlocked with an adjustable motor overload relay.
7. Isolation: Provide a VFD isolation switch or contactor to allow maintenance on the VFD while operating in the bypass mode.
8. Harmonic Mitigation: Provide integrated harmonic distortion mitigating devices designed for the specific VFD to guarantee harmonic distortion limits required herein. VFD system integrated AC reactors, transformers, passive or active harmonic filters or other required devices shall be housed in the single filter ventilated VFD system enclosure isolated by the door interlocked disconnect as a complete UL assembly. Non pre-integrated configurations requiring separate enclosures and components, field mounting, wiring, circuit protection or tuning shall not be permitted. VFD systems shall meet the following THD limits compared to bypass operation:
   a. 5HP and Smaller – VFD systems 5HP and smaller shall include harmonic mitigation to prevent current harmonic distortion (ITHD) from increasing by more than 35% as measured at the VFD system input terminals.
   b. 7.5HP and Larger - VFD systems 7.5HP and larger shall include harmonic mitigation to prevent current harmonic distortion (ITHD) from increasing by more than 15% as measured at the VFD system input terminals.

G. Start-up Services
1. The supplier of the VFD system shall provide field start-up service by an authorized factory trained service representative. The factory representative shall be trained in the maintenance and troubleshooting of the equipment as specified herein. Start-up service shall include system check-out, start-up and system run, and harmonic testing including the following:
   a. Verify that the system voltage is within the manufacturer’s specification tolerances.
   b. Verify that the motor rotation is correct in all modes of operation

c. Verify operator devices, programming and monitoring functions to be fully operational.
d. Measure and record system input and output voltage and current at 100% speed. Tune the output voltage to correspond to the motor nameplate data.
e. Make all parameter adjustments to tune and optimize the VFD system to the application. Record all configuration values as part of the start-up report.
f. Conduct harmonic tests as identified below
g. Program each VFD to automatically restart after a momentary power bump, and after an extended power outage.

H. Harmonic Distortion Report
1. After the installation is complete, measure harmonic voltage and current distortion of each VFD system at its highest operating speed. Submit text and graphical data showing voltage and current waveforms in compliance with the harmonic limits specified herein. Submit voltage and current THD as well as individual harmonic spectrum analysis data.

PART 4 - EXECUTION

4.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the Owners Representative in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

4.2 INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to insure a complete operating system in accordance with the sequences of operation and point schedules.

4.3 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 60 inches above floor with minimum 3'-0" clear access space in front of units. Obtain Owner Representative's approval on locations prior to installation.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration and high temperatures.

C. Identify all equipment and panels. Provide permanently mounted tags to all panels.

D. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections; sized to suit pipe diameter without restricting flow.

4.4 INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with Division 16 and all state and local electrical codes.

B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions.

C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's Representative prior to rough-in.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate with electrical contractor.

F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed in a neat and inconspicuous manner per local code requirements.

4.5 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 15010.

B. Demonstrate complete and operating system to Owner's Representative.

C. Provide certificate stating that control system has been tested and adjusted for proper operation.

PART – 5 SEQUENCE OF OPERATION

5.1 SEQUENCE OF OPERATION

A. HEATING WATER SYSTEM

1. Heating water boilers:
   a. The two heating boilers shall be staged on to maintain 180°F system temperature when the outdoor air temperature is below 65ºF. The condensing re-heat boiler shall be used when ambient outdoor air temperature is above 65ºF. The condensing re-heat boiler shall maintain 125ºF.
      1) The DDC controls shall enable the boilers; when enabled, the DDC control system shall control water temperature based on a 0-10 volt signal.
      2) Each boiler circulation pump shall turn on when boiler is called for and shall run for 10 minutes (adjustable) after boiler is turned off.
      3) There are two heating boilers; the lead boiler and sequenced staging shall be set-up to give equal run time for both heating boilers.
      4) Boiler controls shall interface with controls system through I-net Interface. Interface shall provide at operators work station all functions provided by the boiler interface.

2. Building Hot Water Pumps:
   a. The Building Hot Water pumps shall operate in primary standby.
      1) Lead pump starts and runs whenever a boiler is enabled.
      2) The pump VFD shall modulate to maintain system differential pressure. (The VFD’s shall be purchased and installed under this bid package. The VFD’s shall be purchased from the controls contractor.)

3) Pumps alternate Lead/Lag position on a weekly basis.

3. System Hot Water Supply Temperature Control
   a. Using a single PID control loop, the System Hot Water Boilers modulate to maintain the HWS temperature set point according to the following reset schedule:

Outdoor Temperature	HWS Temp. Set Point
Below 65º F	180º F (adjustable) Max.
Above 75º F	125º F (adjustable) Min. (condensing boiler)
Above 65º F	160º F (adjustable) Min. (non-condensing boiler)

4. The Primary Heating Water graphic displays the following static and dynamic information:
   a. Simple flow diagram showing all Primary Heating Water equipment along with the interconnecting piping.
   b. HWS temperature for each boiler (located prior to boiler recirculation pump loop).
   c. Building HWS and HWR temperature.
   d. Outside air temperature.
   e. The commanded condition of all boiler, pumps, and HWS control valve.
   f. The status condition of all boilers, pumps, and valves.
   g. Alarm condition for each boiler.
   h. All calculated and DDC adjustable set points.
   i. Enable and lead/lag equipment selection points.

5. Boiler Room Emergency Shutdown
   a. Boiler room emergency shut down is provided under Division 16

B. UNIT HEAT CONTROL
1. Hot Water Valve modulates open to maintain a space temperature set point of 65°F (adjustable).
2. Unit heater fan starts on a call for heat and stops when the heating temperature set point is satisfied.
3. The Unit Heater graphic displays the following static and dynamic information:
   a. Simple flow diagram showing a riser diagram of all Unit Heaters.
   b. The Commanded Condition of each Control Valve.
   c. Space Temperature.
   d. Space Temperature Set Point.

C. FAN SYSTEM FILTER BANK ALARMS
1. A differential pressure transmitter with its static pressure tips located across each fan system filter bank & makeup air unit filter bank shall provide the DDC system with the differential pressure drop across each filter bank. An alarm shall be supplied to the DDC system whenever the filter differential pressure remains above 0.35" w.c. for more than 15 continuous minutes.

D. VAV FAN SYSTEMS (AHU#1-AHU#8)

1. Replace existing AHU controllers to be compatible with the TAC INET DDC control system.
2. The VAV fan systems each consist of a supply fan driven by a VFD, a return fan driven by a VFD, a heating coil, a cooling coil, filters & outdoor air, return air and relief air dampers.
3. The supply fan shall be started from a local DDC controller through a "HAND-OFF-AUTO" switch, located on the face of the VFD bypass panel. Relief fan shall run when the supply fan is running and the outside air damper is more than 55% open.
4. In "HAND" position, fan shall operate continuously; in "OFF" position, fan shall be stopped, and in "AUTO" position, fan shall be on during OCCUPIED mode and cycled to maintain minimum space temperature when in the UNOCCUPIED mode.
5. Fan system operation in AUTO mode shall be subject to freezestat, building fire alarm, supply duct high static pressure, building optimal start-stop programs, and other conditions or logic pre-programmed into the DDC controllers.
6. If the fan system is shut-down, or fails to start due to abnormal conditions, an alarm shall be sent to the DDC system. When the fan is stopped under any condition, the outside air damper and relief air dampers shall close.
7. A manual reset, high limit pressure switch sensing supply duct static pressure within the fan room shall shut down the fan and alarm the DDC system if its 3" wc setting is exceeded.
8. OCCUPIED mode: A supply air temperature sensor and an outdoor air temperature sensor, acting through DDC controllers, shall modulate the heating coil valve, outdoor air, return air and relief air dampers, and cooling coil to maintain supply air temperature according to the following schedule:

OUTDOOR AIR TEMPERATURE	SUPPLY AIR TEMPERATURE
55°F	55°F
10°F	65°F

9. Whenever heating valve is not closed or when outdoor air temperature exceeds 76° F, the outside air and relief air dampers shall close to the minimum position as determined by the return duct air quality transmitter and minimum ventilation requirements.
10. A 0-5" w.c. supply duct static pressure transmitter with its static tip located 2/3 of the way down the supply duct and acting through a DDC controller shall modulate supply fan speed to maintain 1" wc supply duct static pressure.
11. A CO2 transmitter located in the return air duct, acting through a DDC controller, shall operate the outside air damper to maintain 800-900 PPM CO2 (adjustable) in return air system.
12. A mixed air temperature sensor, acting through a DDC controller, shall provide 48°F mixed air temperature low limit control of the air handling system. If mixed air temperature drops below 39°F, supply and return/relief fans shall stop, outdoor and relief air dampers shall close and an alarm shall be sent to the local Host Computer.
13. Outdoor air dampers shall remain closed, and return air dampers shall remain open when return air temperature is below 68°F.
14. UNOCCUPIED mode: A space temperature sensor, acting through a DDC controller, shall cycle the supply fan with the heating valve open 100% to maintain desired minimum space temperature.
15. Outdoor air & relief dampers shall remain closed. Chilled water valve shall close to the coil when the supply fan is not running.

16. Supply and return fans shall run on a VFD controlled by duct static pressure.

E. FIRE ALARM FAN SHUT-DOWN: (All Fan Systems)

1. All heating, ventilating and air conditioning system supply fans shall automatically shut off when the building fire alarm system is energized. All fans to automatically start up again when fire alarm system is reset. Fire alarm system fan relays shall be "normally energized" and shall be installed by Division 16 at each fan system.

F. CHILLED WATER SYSTEM CONTROL

1. The chilled water system consists of an air-cooled, multi-compressor chiller/condensing unit and a chilled water pump.
2. When the pump starter mounted H-O-A switch is in the AUTO position, pump shall be controlled by the DDC system.
3. When the building is in OCCUPIED mode and outdoor air temperature is above 60°F, the chilled water system shall be activated.
4. Provide a flow switch in the chilled water line and interlock with the chiller as recommended by the chiller manufacturer.
5. The chiller shall be supplied with factory furnished controls. Once enabled by the DDC system, chiller shall operate under its own control system.

G. VAV BOX CONTROL W/ REHEAT COILS (VAV#1-VAV#88)

1. Replace existing VAV box controllers to be compatible with the TAC INET DDC control system.
2. Room space temperature sensing shall be from wall mounted thermostats or temperature sensing elements. See 15900-8.
3. A VAV box-mounted DDC controller shall be provided for control and operation of each VAV box and reheat coil. Sensor shall modulate the box primary air damper between minimum ventilation position and maximum designed airflow and position the reheat coil valve in sequence to maintain the desired space temperature. Heating and cooling setpoints shall be individually adjustable from the man-machine interface device (Host computer).
4. Each VAV box DDC controller shall have a 24 volt power connection with all 24 volt control wiring by the ATC contractor.

END OF SECTION: